FARMING DEER FOR MEAT

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INTRODUCTION

Deer farming in New Zealand started in 1970 and since that time has grown rapidly so that there are now more than 300,000 deer on farms of which 85% are red deer. This year it is estimated that about 160,000 hinds went to the stag. With the long productive life of female deer and the virtual absence of culling, the number of breeding females almost doubles every 3 years.

The successful development of this new farming system depended on a sound research base and effective extension of research information to the farmer and close co-operation among farmers in sharing their own experiences in deer management. Important basic information has come from research on feed requirements, growth potential, seasonal patterns of growth, carcass composition and general management including animal health. With the increasing sophistication of the industry research is now more concerned with the major product itself, namely venison.

MUSCULATURE

The high priced cuts from any meat animal come from the hind leg and the back around the spinal column (saddle). In terms of these high-priced cuts, the deer is a superior meat producing animal to the sheep or cattle beast (Table 1). In these data, the high-priced muscle groups of the hind leg are relatively 9 and 16% heavier in the mature stag compared with the mature bull and ram respectively. The muscles of the saddle area also form a substantially greater proportion of total muscle in the stag than in the bull and are similar in the ram and stag. Such muscle development is simply the deer's response to its evolutionary environment - it attempts to escape its predators.

TABLE 1 - Comparative muscle weight distribution of mature and red deer stags, rams and a mature bull

	Muscle group as % of total muscle			Relative weight	
	Stags[1]	Rams[2]	Bull[3]	Stag/Ram	Stag/Bull
Proximal hind	28.8	24.9	26.5	116	109
Distal hind	4.9	4.4	3.7	111	132
Spinal	14.8	15.5	11.5	95	129
Abdominal wall	5.9	10.5	9.3	56	63
Proximal force	10.7	10.7	13.1	100	82
Distal fore	2.4	2.8	2.5	87	96
Thorax/neck	30.3	28.6	31.8	106	95
Scrap muscle	2.2	2.4	1.6		

1 Wallace 1983, 6 stags
2 Butterfield et al. 1983b, 39 rams
3 Berg and Butterfield 1976, 1 bull

SEASONALITY

Red deer are a species of temperate origin and exhibit a very marked seasonal pattern of feed intake and weight change. This occurs even in young males fed to appetite, where the cyclical growth pattern is characterised by high rates of weight gain in spring and summer with much lower gains in autumn and winter. The cyclical pattern is even pronounced in older stags who may lose a large proportion of their body weight during the autumn rut and winter. The annual pattern of food intake is best considered as being composed of two cycles superimposed on one another. The basic cycle has feed intake increasing through the spring to reach a maximum in early summer followed by a decline which levels out at about a maintenance level of feed intake during winter. However superimposed upon this cycle in the adult male is the sexual cycle. In this case the rising level of testosterone in the early autumn is associated with a dramatic decline in feed intake with a consequent mobilisation of body reserves and loss of a large proportion of body weight (Figure 1). When body fat has fallen to a very low level, feed intake increases and the stag given adequate feed will maintain body weight through winter.

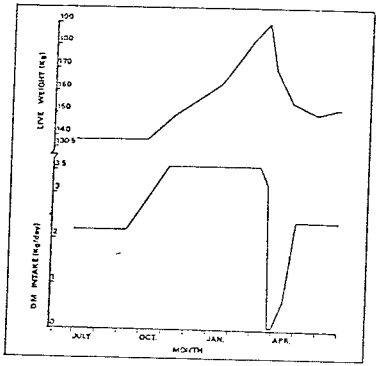

Figure 1 - The pattern of liveweight and feed intake in red deer stags, aged 2.5 to 3.5 years.

SEASONALITY AND FEED REQUIREMENTS

It has often been said that the seasonal pattern of growth of the deer fits ideally into the pattern of pasture production in our temperate grasslands. Unfortunately there is a quantum jump built into this statement - namely that weight gain reflects feed intake. In simple terms, the maintenance requirement of a deer at pasture in winter is substantially higher than the same deer in summer simply because of the influence of wind chill (Fennessy et al., 1981). Red deer are relatively poorly insulated. In addition they have a very low level of fat reserves, especially the stags - that is, they are lean. Therefore to ensure good survival rates of deer - especially adult stags post-rut and young deer - it is essential to offer high amounts of high quality feed in winter to ensure that they can consume their total energy requirements with ease without having to spend all day eating. The availability of effective shelter can also substantially reduce feed requirements at this time of the year.

CARCASS COMPOSITION

YOUNG ANIMALS

This highly seasonal pattern of growth indicates the obvious options for timing slaughter of young stags as being at the end of growth 'spurts' in March at 15 or 27 months of age. Even though such stags will have reached about 50-55 and 65-70% of their mature weight they are still very lean when compared with traditional livestock (Table 2).

TABLE 2 - Weight and fatness data for red deer stags compared with a ram lamb

	Age (months)	Liveweight kg	Liveweight % of mature wt	Hot carcass weight (kg)	Fat %
Red deer stag	14/15	100	50	56.5	9.5
	26/27	132	66	78.0	13.1
Ram lamb	6	40	36	17.0	21.8

MATURE ANIMALS

As mentioned previously the highly seasonal pattern of weight change is accompanied by dramatic changes in carcass composition (Drew 1985). Table 3 presents data from carcass dissection of mature stags pre- and post-rut, showing that 95% of all carcass fat was lost from stags over the period of the rut. Wallace and Davies (1985) obtained similar results and they also found that the carcass subcutaneous fat was mobilised earlier than the intermuscular depots.

TABLE 3 - Dissected tissues (kg) from mature stags

	Pre-rut March	Post-rut May	Loss %
Liveweight	203	151	25
Carcass weight	122	87	28
Carcass lean	80.5	72.4	10
Carcass fat	25.4	1.2	95

The adult stag is visually grossly overfat prior to the rut but even so in terms of total carcass a stag is very lean when compared with sheep or cattle especially at the same relative stags of maturity (Table 4).

TABLE 4 - Comparative composition of cattle, sheep and deer at maturity

	Weight (kg)		% Components		
	Fasted live	Cold carcass	Fat	Lean	Bone
Steer[1]	755	505	54	39	7
Ram[2]	98	52	43	46	11
Stag pre-rut	190	120	21	66	13
post-rut	146	87	1	83	16

1 Bond et al., (1982), Angus steers
2 Adapted from Butterfield et al., (1983a)

CASTRATION

If there is one practice designed to destroy many of the advantages deer have in meat production, it is castration. Castration by removing the effect of male hormones causes a change in the way the animal uses its feed such that fat deposition is increased, growth rate declines and lean tissue gain declines dramatically (Table 5). As well the stag does not rut and therefore does not shed the surplus fat rendering the animal useless for the production of lean meat. It is this seasonality of the male deer which in the farmed situation, provides a second chance to produce a lean product by slaughtering stags in the winter (Table 3).

TABLE 5 - The effect of castration in stags[1]

	Entire	Castrate	% Change
Carcass weight at 27 months (CW kg)	68	56	-17
Carcass composition at 60 kg CW			
Fat %	10.7	12.4	+16
Water %	63.2	61.3	- 3
Forequarter muscle (kg)	14.6	13.6	- 7
Hindquarter muscle (kg)	18.4	19.6	+ 7

1 Drew et al., 1978; Tan and Fennessy 1981

However there is a remarkable paradox with the highly seasonal entire male deer in that during spring-early summer when the potential for growth is very high the stag is virtually a functional castrate. This is the period when the stag is growing his antlers and at this time there are only very low levels of testosterone present as a result of very inactive testes (Fennessy and Suttie 1985). In fact, there is so little testosterone that it is possible to substantially increase growth rate by treatment with steroids (Suttie et al., 1985) or other growth promoters with steroid-like action. A comparison of the effects of castration and zeranol treatment is given in Table 6. Such growth promoters cannot be recommended however where venison is to be sold as a natural game product and consumer perception of the product is the all important point.

TABLE 6 - Influence of castration and zeranol treatment on rate of liveweight gain (LWG) of rising 2 year old deer in spring

	Expt. 1[1]		Expt. 2[2]	
	Castrate	Entire	Entire	Zeranol
LWG (g/day)	201	266	330	394
n	5	6	8	9
Relative LWG	76	100	100	119

1 Drew et al., 1978 - stags castrated at 5 months of age

2 P H Fennessy and G H Morre (1977, unpubl.) - 12 mg Ralgro (Cooper Wellcome) subcutaneously

VENSION AS HUMAN FOOD

Research into the health of modern society has lead to major interest in the nutrition of the 20th century western society as compared with the nutrition of primitive man operating during our evolutionary history (see Eaton and Konner 1985). One of the factors highlighted has been the very high quantities of saturated fat eaten by consumers of the products of modern intensive livestock farming. Carcass composition has then been compared with wild herbivores and the very low fat of the wild animals noted. However the reasons why wild animals are often (but not always) lean is frequently overlooked. In our work at Invermay we have consistently found that wild deer are leaner only because they are

lighter than farmed deer and at the same carcass weights wild deer have the same amount of total carcass fat as farmed deer. In terms of fatty acid composition, the major polyunsaturated fatty acids are present in the phospholipid fraction, and the amount per kg of tissue does not differ greatly between farmed and wild deer. Of course, if farmed deer are heavier than wild deer and are slaughtered at the same age and time of year, they will have more fat and therefore the caloric density of the total product will be higher (Table 7). However even with the heavier animals the fat can be easily trimmed off.

TABLE 7 - Comparative composition of untrimmed hind leg meat from wild and farmed deer[1]

	Wild	Farmed	
Age (months)	27	12	27
Carcass weight (kg)	43	41	76
Components (g/100 g)			
Lean	95.6	95.6	88.0
Fat	3.2	3.3	10.9
PUFA[2]	0.5	0.3	0.3
Caloric density (MJ/100 g)	685	685	920

1 Adapted from Manley and Forss (1979) and T R Manley (unpublished data)

2 Polyunsaturated fatty acids.

EFFICIENCY OF MEAT PRODUCTION

Over the years there has been much hypothesising that deer are more efficient converters of grass to meat than other grazing livestock. The ways in which such an effect could operate include:

1. If deer have a higher proportion of lean tissue (ie. protein plus water) in the main than the other species (it is more efficient to lay down lean meat with its high water content and lower energy than it is to lay down fat with its high energy and low water).

2. If the deer has a higher relative rate of liveweight gain, ie. attaining a relatively higher proportion of its mature weight at a young age while remaining lean.

3. A lower proportion of the total feed consumed goes into maintenance leaving a higher proportion for weight gain.

With regard to the first factor there is little doubt that male red deer do fulfill this criterion although young entire male cattle may also be very lean (K R Drew and A J T Pearse, unpublished). In terms of relative rate of gain, it appears that male deer and cattle are similar, attaining about 50% of their mature body size at 15-18 months, although there is clearly scope with good management to improve weight gains in deer so that stags achieve 55-60% of their mature weight at 15-18 months. With regard to the third factor, it is a simple fact of life that other things being equal a greater number of smaller animals consuming a given amount of feed will use a greater proportion for simply maintaining themselves and less for production than a lesser number of larger animals consuming the same total amount of feed. Although it is too early to make any definitive statements, the only direct comparison between male cattle and red deer would suggest that this is the case (Table 8). However, if the cattle had been castrated (as they are in many production systems) then it could be expected that the result would be different.

TABLE 8 - Liveweight gain (LWG) and meat production from Friesian x Angus bulls and red deer stags grazing pasture at Invermay (150 days, Sept 1 to Jan 23)[1]

	Stocking rate (animals/ha)	LWG (g/day)	Carcass gain (kg/ha
Bulls	6.4	1390	720
Stags - rotationally grazed	30	204	540
- set stocked	26	221	505

1 A J T Pearse and K R Drew, unpublished

Clearly deer as a meat producing animal are going to have to make it on the merits of their products and not on their imagined advantages in efficiency of production. However in comparison with sheep and cattle, the numerous by-products from the deer can make very valuable contributions. However investigations of the efficiency of the whole system, including the breeding side of the equation are necessary before definitive statements can be made, but any margin of efficiency of meat production for deer will not be spectacular.

REFERENCES

Berg, R.T. and Butterfield, R.M. (1976). New Concepts of Cattle Growth, John Wiley & Sons, New York.

Bond, J., Warwick, E.J., Ottjen, R.R. et al. (1982). Growth 46: 388-403.

Butterfield, R.M., Griffiths, D.A., Thompson, J.M. et al. (1983a). Animal Production 36: 29-37.

Butterfield, R.M., Zamora, J., James, A.M. et al. (1983b). Animal Production 36: 165-174.

Drew, K.R. (1985). In 'Biology of Deer Production' edited by P F Fennessy and K R Drew. Royal Soc. N.Z. Bull. 22: 285-290.

Drew, K.R., Fennessy, P.F. and Greer, G.J. (1978). Proc. N.Z. Soc. Anim. Prod. 38: 142-144.

Eaton, S.B. and Konner, M. (1985). New England Journal of Medicine 312: 283-289.

Fennessy, P.F., Moore, G.H. and Corson, I.D. (1981). Proc. N.Z. Soc. Anim. Prod. 41: 167-123.

Fennessy, P.F. and Suttie, J.M. (1985). In 'Biology of Deer Production' edited by P F Fenness and K R Drew. Roy. Soc. N.Z. Bull. 22: 239-250.

Manley, T.R. and Forss, D.A. (1979). J. Sci. Food Agric. 30: 927-931.

Suttie, J.M., Corson, I.D. and Fennessy, P.F. (1985). The Deer Farmer (24): 13-14.

Tan, G.Y. and Fennessy, P.F. (1981). N.Z. J. Agric. Res. 24: 1-3.

Wallace, V. (1983). Pre- and post-rut body composition of the red deer stag. B. Phil. thesis; Massey University, Palmerston North.

Wallace, V. and Davies, A.S. (1985). In 'Biology of Deer Production' edited by P F Fennessy and K R Drew. Roy. Soc. N.Z. Bull. 22: 291-293.